What Is Claimed Is:

1. A method of forming a silicon carbide barrier layer on a substrate, comprising:

a) introducing silicon, carbon, and a noble gas into a chamber;

b) initiating a plasma in the chamber;

b) reacting the silicon and the carbon in the presence of the plasma to form silicon carbide; and

c) depositing a silicon carbide barrier layer on the substrate in the chamber.

2. A method of claim 1, wherein the silicon comprises a silane.

3. A method of claim 1, wherein the silicon and carbon are derived from ~~a common~~ methylsilane, independent of other carbon sources.

4. A method of claim 1, further comprising depositing the silicon carbide barrier layer at a temperature of between about 100° to about 450° C.

5. A method of claim 1, further comprising depositing the silicon carbide barrier layer at a temperature of between about 300° to about 400° C.

6. A method of claim 1, further comprising producing a silicon carbide barrier layer having a dielectric constant of no greater than about 6.

7. A method of claim 1, further comprising producing a silicon carbide barrier layer having an effective dielectric constant of no greater than about 3.

8. A method of claim 1, further comprising producing a silicon carbide barrier layer which is copper diffusion resistant.

9. A method of claim 1, further comprising producing a silicon carbide barrier layer having a copper diffusion of about 300 Å or less.

no property di-mat. or structure

10. A method of claim 1, wherein reacting the silicon and the carbon comprises reacting the silicon and the carbon while maintaining a chamber pressure between about 6 to about 10 Torr.

11. A method of claim 1, wherein reacting the silicon and the carbon comprises reacting the silicon and the carbon using an RF power supply supplying a power density of about 4.3 to about 10.0 watts per square ~~centimeter~~ inch to an anode and cathode in the chamber.

A

12. A method of claim 1, wherein providing the silicon comprises providing a silane flow rate of between about 10 to about 1000 sccm and providing the noble gas comprises providing a helium or argon flow rate of between about 50 to about 5000 sccm.

13. A method of claim 1, wherein providing the silicon, the carbon, and the noble gas comprises providing a methylsilane flow rate of between about 30 to about 500 sccm as the silicon and carbon source and a helium or argon gas flow rate of between about 100 to 2000 sccm as the noble gas source and further comprising reacting the silicon and the carbon in a chamber pressure range of about 3 to about 10 Torr with an RF power source supplying a power density of about 4.3 to about 10.0 watts per square ~~centimeter~~ inch to an anode and cathode in the chamber and a substrate surface temperature of between about 200° to about 400° C and having a showerhead to substrate surface spacing of between about 300 to about 600 mils.

A

14. A method of claim 1, wherein the silicon carbide barrier layer comprises an etch selectivity ratio of ~~at least~~ about 40 to 1.

15. A method of forming a silicon carbide passivation layer on a substrate, comprising:

a) introducing silicon, carbon, and a noble gas into a chamber;

b) initiating a plasma in the chamber;

b) reacting the silicon and the carbon in the presence of the plasma to form silicon carbide; and

c) depositing a silicon carbide passivation layer on the substrate in the chamber.

16. A method of claim 15, wherein the silicon and carbon comprise ~~a~~ methylsilane.

17. A method of claim 15, further comprising depositing the silicon carbide barrier layer at a temperature of between about 300° to about 400° C.

18. A method of claim 15, wherein reacting the silicon and the carbon comprises reacting the silicon and the carbon using a chamber pressure between about 6 to about 8 Torr.

19. A method of claim 15, further comprising producing a silicon carbide passivation layer having no substantial penetration of moisture.

20. A method of claim 15, wherein reacting the silicon and the carbon comprises reacting the silicon and the carbon using an RF power supply supplying a power density of about 8.6 to about 14.3 watts per square inch ~~centimeter~~ to an anode and cathode in the chamber.

21. A method of claim 15, wherein providing the silicon, the carbon, and the noble gas comprises providing a methylsilane flow rate of between about 100 to about 500 sccm as the silicon and the carbon source and providing a helium or argon gas flow rate between about 1000 to about 2000 sccm as the noble gas source and further comprising reacting the silicon and the carbon in a chamber pressure range of about 6 to about 8 Torr with an RF power source supplying a power density of about 8.6 to about 14.3 watts per square ~~centimeter~~ inch to an anode and cathode in the chamber and a substrate temperature of between about 200° to about 400° C and having a gas dispersion head to substrate spacing of between about 200 to about 600 mils.

A

22. A method of claim 15, wherein the silicon and carbon are derived from a common methylsilane, independent of other carbon sources.

Sub B

23. A substrate having a silicon carbide layer, comprising:

a) a semiconductor substrate;

b) a dielectric layer deposited on the substrate; and

c) a silicon carbide layer having a dielectric constant of about 6 or less.

24. The substrate of claim 23, wherein the silicon carbide layer comprises an effective dielectric constant of about 3 or less.

25. The substrate of claim 23, wherein the silicon carbide layer comprises a copper diffusion of about 300 Å or less.

26. The substrate of claim 23, wherein the silicon carbide layer comprises an etch selectivity ratio of at least about 40 to 1.

27. The substrate of claim 23, wherein the silicon carbide layer is produced by the process of providing silicon, carbon, and a noble gas comprising providing a methylsilane flow rate of between about 30 to about 500 sccm as the silicon and carbon source and a helium or argon gas flow rate of between about 100 to 2000 sccm as the noble gas source and further comprising reacting the silicon and the carbon in a chamber pressure range of about 3 to about 10 Torr with an RF power source supplying a power density of about 4.3 to about 10.0 watts per square ~~centimeter~~ inch to an anode and cathode in the chamber and a substrate surface temperature of between about 200° to about 400° C and having a showerhead to substrate surface spacing of between about 300 to about 600 mils.